

## REMARKS

Status of the Claims

Claims 1, 3 – 13, 20 – 21, 23, 24 and 26 – 37 are pending. Claims 2, 14 – 19, 22, 25 have been cancelled. Claims 28 – 32 have been withdrawn from consideration.

The Office Action indicates that claims 1, 3 – 13, and 27 are allowed and that claims 22 and 26 would be allowable if rewritten in independent form.

Claim Amendments

The amendment to Claim 1 finds support throughout the original specification, including in paragraph [0052].

Claims 7 and 9 have been amended for clarity.

Claims 20, 23 and 26 have been amended and claim 22 has been cancelled as suggested by the Office Action.

Claims 33 to 37 have been added to recite features commensurate with the present invention as supported in the application as filed.

As known in the art, fracture toughness may be characterized through a critical stress intensity factor  $K_{1C}$  (in units of  $\text{MPa}\cdot\text{m}^{1/2}$ ) and a critical strain energy release rate  $G_{1C}$  (in units of  $\text{J}/\text{m}^2$ ) (see paragraph [0087]).

New claim 33 finds support throughout the original specification, including for example in claim 22 (now cancelled), and Figure 25 as filed. In Figure 25, the strain energy release rate, i.e.  $G_{1C}$ , is shown to increase from about  $125 \text{ J}/\text{m}^2$  at 0 clay to about  $600 \text{ J}/\text{m}^2$  at about 4 phr clay, and thus supports that the value of  $G_{1C}$  for epoxy without rubber at about as low as 4 phr (parts per hundred) clay is at least about 4.8 times the value of  $G_{1C}$  at 0 clay loading.

New claim 35 finds support throughout the original specification, including for example in claim 26 and Figure 24 as filed. In Figure 24,  $G_{1C}$  is shown to increase from about  $75 \text{ J}/\text{m}^2$  at 0 clay to about  $450 \text{ J}/\text{m}^2$  at about 20 phr of CTBN rubber and about 4 phr clay, and thus supports that  $G_{1C}$  is increased by at least

about 4.8 times for epoxy with rubber at about 20 phr of CTBN rubber and as low as about 4 phr clay loading.

New claims 34, 36 and 37 finds support throughout the original specification, including for example in claim 7 as filed.

#### Restriction Requirement

The Office Action asserts the application contains more than one invention as identified in the following table:

Group	Claims	Subject Matter
I	1, 3 – 13, 20 – 24, 26, and 27	(1) A modified epoxy comprising a mixture of a clay solution (clay + solvent) and a pristine epoxy, and (2) A method of making the modified epoxy.
II	28 – 32	A composite epoxy comprising clay agglomerates and a pristine epoxy.

Applicants elect claims 1, 3 – 13, 20 – 24, 26 and 27 of Group I identified by the Examiner for prosecution in the current application.

#### Claim Rejections

- I. The rejection of Claims 20, 21 and 24, citing XP008051803 by Chen et al. (hereinafter "Chen") and either 35 U.S.C. § 102(e) or 35 U.S.C. § 103(a) is traversed and should be withdrawn.

Claim 20 has been amended as suggested by the Office Action (see OA bottom p. 3 - top p. 4, and pp. 7 and 8).

Chen's product does not possess the characteristics of the presently claimed product. As previously mentioned (see the reply dated June 14, 2011), the problem of brittleness, i.e. low fracture resistance, of the epoxy resin is a large obstacle for damage tolerance in composite materials. A lot of efforts have been made by many people to improve the fracture resistance. The fracture resistance is exhibited by the fracture toughness. Even though Chen also produced epoxy/clay nanocomposites, Chen's product is different from the product of the present invention. Chen's product does not have similar

performance in terms of fracture resistance than the product produced by the present invention. For that matter, many other people have also mixed clays and epoxies before, but their results are not good since they could not improve the fracture resistance. The present invention provides a new method that allows fabricating new products.

For at least these reasons favorable reconsideration is respectfully requested.

II. The rejection of Claim 23, citing 35 U.S.C. § 103(a) Chen, and US 4,465,542 to Furihata (hereinafter "Furihata") is traversed and should be withdrawn.

Claim 23 has been amended as suggested by the Office Action (see OA at p. 8).

As mentioned above, Chen fails to teach or hint at the product of the present invention. Even if a person having ordinary skill in the art had added rubber to the composition of Chen on the ground that Furihata recognizes rubber materials as suitable modifiers for epoxy/clay composites, the skilled artisan would not have obtained the presently claimed product, as explained hereinabove in relation to claim 20.

For at least these reasons favorable reconsideration is respectfully requested.

Fee Authorization

The Director is hereby authorized to charge any deficiency in fees filed, asserted to be filed, or which should have been filed herewith (or with any paper hereafter filed in this application by this firm) to our Deposit Account 14-1437. Please credit any excess fees to such account.

Conclusion

The rejections of the claims are overcome by the present remarks and amendments. Therefore, favorable action in the form of a Notice of Allowance is believed to be in order, and such an action is respectfully requested.

Respectfully submitted,  
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